Space Weather Technical Forecast

Issued on Tuesday, 09 August 2022 at 12:07 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Reducing Chance of further Minor Geomagnetic Storms through midweek. Active electron fluence Likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Very Low over the past 24 hours, with only B-class flares recorded at GOES16. There are now up to six sunspot regions on the visible disc, with a new region just becoming visible on the southeastern horizon. All of these sunspots currently appear either magnetically unipolar, or else simple dipoles. The most dynamic of these sunspots was an unnumbered Bxo/Beta group that appeared between AR3071 and AR3074, with growth and proliferation of spots observed, however this did not culminate in any flares.

No Coronal Mass Ejections (CMEs) were visible in available imagery. A filament seen leaving the northern centre disc immediately prior to this 24-hour period was modelled and determined to most likely pass above the plane of the ecliptic to no effect at Earth.

Solar Wind / Geomagnetic Activity: Earth is currently under the influence of the fast wind from a positive polarity coronal hole. The source of this is becoming less certain, but is most likely to be either CH10/+ or the recent CH09/+, with no obvious transition having occurred between the two in the period. the phi angle has been accordingly positive (towards the Sun) throughout the 24 hours.

The solar wind speed, as recorded at L1 by DSCOVR and ACE was Elevated through the period, with a very slight decline evident and a range mostly between 550-600km/s, with the precise figure differing according to the observing satellite used. The solar wind density also showed a slight decline into single figures ppcc. The IMF decreased in magnitude relative to the previous UTC day's values, remaining within long-term background and with a maximum value of 8nT and a volatile north-south component ranging between +6 and -7nT.

The net result of the above solar wind measures was provisionally Quiet to Active Kp, with a peak of 4o observed in the 03-06UTC interval.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV), as measured by GOES16, was at Background levels.

The high energy electron flux (greater than 2 MeV) rose sharply from initial Moderate flux to peak at High in its diurnal oscillation, with 2520pfu observed at 09/0350UTC. The 24-hour integrated electron fluence was 4.54e7 integrated pfu at 09/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low or Very Low solar activity is Expected.

Solar Wind / Geomagnetic Activity: No CMEs feature in the current forecast.

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Solar winds are forecast to be Elevated due to a succession of high speed streams: respectively CH09/+, CH10/+ and perhaps CH12/+ in turn. CH12 has only recently appeared and may not manifest at Earth, and in any case transition between all of these features may be indistinct for their all being of the same polarity.

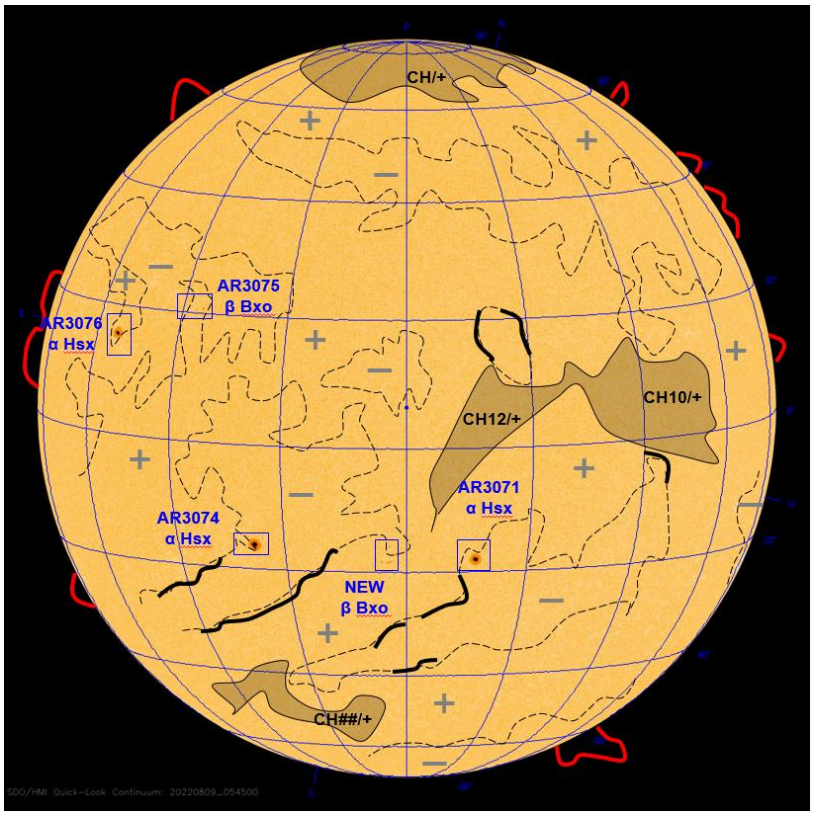
There remains a decreasing Chance of G1 on days one and two (through to Wednesday 10 August) as a result of the train of positive coronal holes, with the second half of the UTC week then likely to see increasingly Quiet geomagnetic conditions.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at Background levels.

The high energy electron flux (greater than 2 MeV) is likely to continue increasing towards midweek UTC, with diurnal maxima likely above the 1000pfu threshold. The ongoing protracted G1 risk may bring some brief spells of background or moderate electron flux levels, but as we exit any coronal hole influences by the end of the week, the risk of period of elevated flux will likely rise.

The associated fluence is expected to rise is response to prolonged periods of active flux, but may be subdued if we have further G1 periods. As indicated by REFM, there is a rising trend of the Active threshold being breached (1e8 integrated pfu) if not later on day 1 (09 August), then likely day 2 (10 August) onwards.

Figure 1. Solar Analysis Valid 09/0545UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No CMEs feature in the current forecast, all previous filament lift-offs have been modelled as not being Earth-directed.

Solar winds are forecast to be Elevated for much of the period due to a succession of high speed streams that may be indistinct for all possessing positive polarity. These are respectively: CH09/+ (now over the northwest limb); CH10/+; and perhaps CH12/+. This final coronal hole appears to have opened up late in the past UTC weekend close to the central meridian and may now give a more protracted spell of fast winds. This may also result in a prolonged G1 risk, depending on whether there is an intervening lull and CIR or if the features form one continuous longer-lasting fast wind. Confidence in CH12/+ being geoeffective is lower as it may have opened too late to manifest at Earth, as any fast wind emanating from CH12 will have a transit time to 1AU. There remains no obvious sign at STEREO A, two days upwind, although this satellite would be even less likely to see any fast wind.

Geomagnetic activity is now thought likely to carry a more prolonged risk of G1 through midweek as a result of the succession of CH09, CH10 and now perhaps CH12. Solar winds may remain slightly elevated later this working week, however the threat of further G1 should recede as the features mature, and Unsettled activity is perhaps more likely by this time.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	25	10	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

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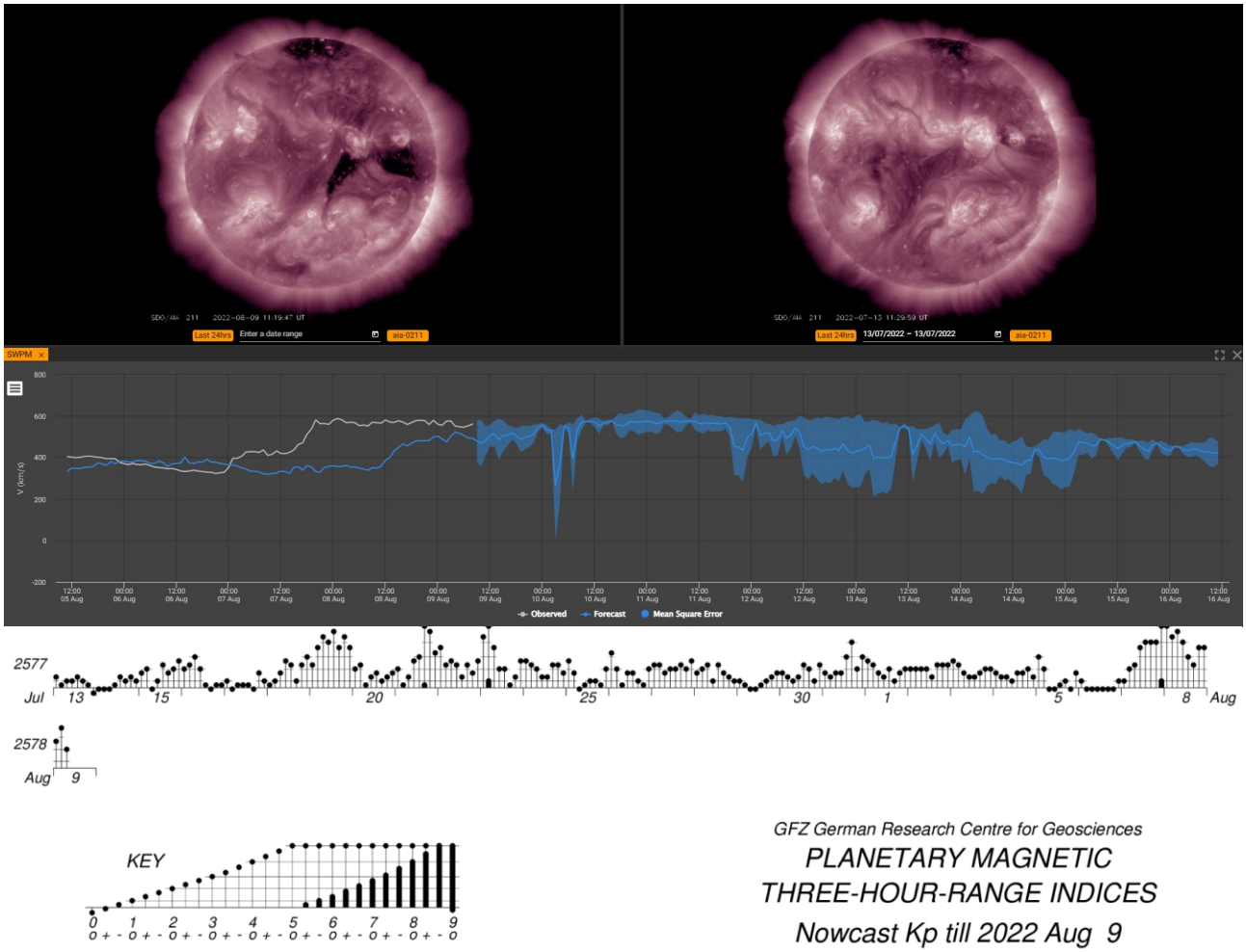
Figure 2: Persistence in AIA 211; solar wind at L1 and observed Kp, showing more intense successor to CH10, probably giving a long-lasting spell near 500-600km/s when taken with CH12. The increasing proximity to the autumnal equinox and the positive polarity are also factored into the remaining Slight Chance of G1 through midweek, although geomagnetism from the train of coronal holes has probably already peaked.



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Radio Blackouts - X-Ray Flares:

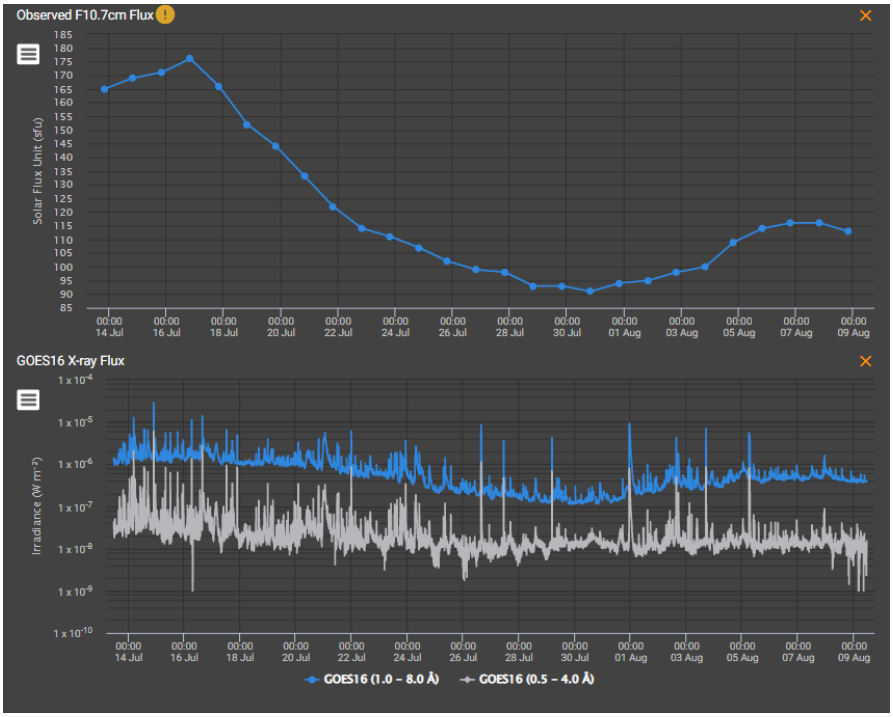
There are now up to six sunspot regions on the solar disc, with a new arrival becoming visible on the southeastern limb, and with a minor proliferating bipolar spot in the central southern hemisphere. None of the current sunspot groups appears particularly noteworthy, with no flares recorded.

There are hints on STEREO A EUVI 195 imagery of a further two bright flux regions waiting in the wings narrowly over the eastern limb, however any contribution to flare risk will be assessed as and when any region(s) appear for analysis.

The outlook is for greater chances of flares, but this depends on arrivals over the eastern horizon and any front-sided development, and should be considered against the current very low baseline of activity.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	1	1	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: Past rotation in GOES16 X-ray flares and Penticton 10cm flux, showing a relative lull in activity in the past fortnight.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels, and is expected remain at this level through the period given the dearth of significant sunspot regions.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2 MeV) appears to be in a phase of adjustment to a new higher-magnitude diurnal oscillation, with the daily maximum of the 24-hour period occurring at the time of the usual minimum at GOES16. This suggests that the current flux oscillation may peak at higher levels in the next 24 hours, however there remains the threat of further geomagnetic activity which may serve to repeatedly dent counts at GEO.

As the threat of G1 recedes, so the risk of Active electron fluence should increase, becoming Likely from midweek UTC. Given the quieter end to the week geomagnetically-speaking, electron levels attained by midweek should persist into the forthcoming UTC weekend.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	50	60	70	70
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	5	5	5

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Figure 4: Past 24 hours in high energy electron flux at GOES16 (top) and latest MOSWOC REFM. In the absence of geomagnetic activity, Active fluence would very likely be realised within the UTC day, however there remains a risk of further Active intervals and perhaps even G1 given solar winds of around 550km/s. These will serve to dent electron counts at GEO through midweek, with levels then expected to settle towards the end of the UTC working week.

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